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PROJECTING NATURAL GAS PRICES IN WESTERN MONTANA

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PROJECTING NATURAL GAS PRICES

IN WESTERN MONTANA

By

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Prepared for the Montana Department of Administration
and Montana Energy Advisory Council

Summary

This report forecasts substantial increases in the price of natural gas used in Western Montana. The increases amount to about 40 percent by 1980 over 1976 costs for residential and commercial users, and about 55 percent for industrial users. Little increase is expected through the 1980's. The cost figures used throughout the report are in 1976 dollars, so that if general inflation continues, prices charged in future years will be higher in dollar amounts, though not higher in real terms (goods and services sacrificed to obtain gas).

Table 1

Summary of Gas Price Projections
Western Montana (1976 dollars)

Year	Residential and Commercial (12.94 psi)		Industrial (14.9 psi)	
	per MCF	per million BTU	per MCF	per million BTU
1976	$1.66	$1.82	$1.41	$1.35
1980	2.34	2.57	2.20	2.10
1985	2.44	2.68	2.31	2.20
1990	2.40	2.64	2.27	2.17

The 1976 figures reflect estimated cost of service, which may not be fully reflected in user prices due to rapidly rising gas prices and regulatory lag.*

Important gas conservation and fuel switching is already underway among industrial gas users, who are finding many ways to reduce gas consumption.

Conservation is also expected among residential and commercial users, although natural gas will remain a cheaper source of heat than electricity or propane.

The major determinant of gas prices will be the cost of gas available to the utilities. A key factor in this report's estimates is the availability through 1990 of substantially increased quantities of gas produced in Montana. Supply estimates are based largely on results of the producer survey reported in Frizzell (1, p. 74). Those supply results are consistent with national estimates of supply elasticity, which imply that a given percentage increase in wellhead price leads to about half that percentage increase in quantity available to pipelines. However, even if the estimates used herein are reduced 20 percent, there is very little impact on price, and no need during the 1980's for gas from Canada. The Montana gas estimate could be cut in two, and all Canadian gas eliminated, and it appears that SNG would not be demanded.

The price of gas will undoubtedly continue to rise rapidly in the near future. Little increase beyond 1980 is expected however, and gas should remain a comparative bargain for space heating use wherever coal is inappropriate. There should be no crisis of supply in the next few decades at the new higher prices.

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*Figures for 1976 derived from estimates in testimony of J.W. Heidt, The Montana Power Company Docket No. 6454, Before the Public Service Commission of the State of Montana, Figure JWH-2, with industrial gas assumed at 14.9 psi, and all other gas sold in Montana considered as "Residential and Commercial" and assumed delivered at 12.94 psi. To cover Great Falls Gas Company costs, $1.4 million was added, and the Company's sales were considered non-industrial.

Introduction

This report, predicting natural gas prices in the service area of the Montana Power Company and Great Falls Gas Company is intended primarily as an aid to decision making in the office of the State Architect. A companion report by Professor John Duffield predicts electricity prices. A secondary goal is to provide information to the Montana Energy Advisory Council staff, whose members were helpful in several phases of this work.

The project reported upon herein was short -- about one month in duration -- and otherwise limited so that it represents a compilation and analysis of existing data in a somewhat simplistic fashion. A sophisticated engineering or econometric effort was not possible. The projections made here are intended to be reasonably accurate, though surely imprecise estimates of what natural gas prices to industrial and other users will be in 1980, 1985, and 1990. Prices are calculated to meet two conditions: a) quantities demanded are equal to quantities supplied; and, b) the utility revenues are sufficient to cover cost, including return to equity capital. In all cases, prices are in 1976 dollars. This means that inflation will cause prices to be higher, but not the real burden: goods and services given up to get the gas.

Projections are made under the primary -- most likely -- set of assumptions, discussed in the next two sections. Then some alternative assumptions are used to generate alternative price projections.

Natural Gas Demand

Two components of natural gas demand are considered here: industrial

demand and all other, henceforth considered as "residential and commercial." In the latter category are included all sales of the Great Falls Gas Company, although about 7 percent of this firm's sales are industrial. Both categories of demand are responsive to price increases. When the real cost of gas rises, users respond with conservation measures, and by fuel switching. The latter is important with industrial users, who can often switch to coal or other cheaper fuel. The degree to which gas use falls as gas price rises (other factors accounted for) is measured by its price elasticity: the percentage by which use changes, divided by the percentage change in price causing the change in use.

Industrial demand, in the primary projections, is estimated from 1975 industrial usage reported in Montana Historical Energy Statistics (4, p. 54) and from industrial gas savings projected in Frizzell (1, pp. 37, 38). Interviews with the large industrial gas users were used by Frizzell in compiling his projections.

Residential and commercial demand is estimated using rates of increase in use per capita in Western Montana, forecast in Energy Consumption in Montana: Projections to 1990 (2, p. 12), projections on statewide population reported in the same source, and price elasticity figures from FEA's National Energy Outlook - 1977 model. The elasticity figures in Table 3 were reported in a telephone conversation by Lou Rubin of FEA, to the author, on December 15, 1976. An average of the five year residential and commercial gas price elasticities, weighted by 1975 Montana gas use, was utilized. All non-industrial usage in 1975 was escalated in this fashion, including all Great Falls Gas Company sales. The prices at which the specific non-industrial gas sales above would occur, were projected by the author from time

Table 2

Projected Western Montana Gas Demands
in bcf at 14.9 psi

Class	1980	1985	1990
Industrial*	19.4	18.6	17.8
Residential** and Commercial	30.6 (at $1.055)	34.7 (at $.944)	38.9 (at $.83)

*Source: (1)

**Source: (2)

Table 3

FEA Elasticity of Demand for Gas
(own-price responsiveness)

Class	1980	1985	1990
Residential	-.45	-.53	-.55
Commercial	-.61	-.77	-.84
Weighted average	-.52*		

*Used in this study throughout, subject to limit of 1/3 (1980) or 50 percent (1985 and 1990) reduction in projected residential and commercial demands in preceding table.

trend data on residential and commercial prices, 1963-1972, in Energy Consumption in Montana: Projections to 1990 (2). The quantity figures had been derived in that publication using temperature and time trends 1967-1974, so that the lagged impacts of 1963-1972 prices probably comprise nearly all the price influence on that quantity trend. Thus after each price-quantity pair was forecast for 1980, 1985, and 1990, the FEA price elasticity figure for each of those years -- the average of residential and commercial figure, weighted by 1975 wage -- was used to generate other price-quantity pairs for each year. A limit of one third in possible per capita savings of gas from the initial quantity projection in 1980, and 50 percent in 1985 and 1990 was assumed to characterize the demand relationship. Thus in 1980, when the projection for residential and commercial use was 30.6 bcf (billion cubic feet) at $1.06 per mcf (thousand cubic feet), it was assumed that even with extremely high prices, at least two thirds, or 20.4 bcf would be used. The rationale here is that not enough time is available by 1980 to allow full user adjustment. Also, even after several years of experience at high prices, practical limits to the degree of conservation are reached. Savings of 50 percent seem roughly consistent with figures in the literature.

To calculate quantities demanded at other prices, the price elasticity -.52 was used. Thus for example a fall in price to $.81 would cause an increase in use to 34.3 bcf, while a rise in price to $2.07 would drop use to 15.3 bcf. But since the latter quantity is below 20.4, it would be assumed that use would remain at 20.4 bcf, even at higher prices. Other sample calculations are found in Appendix B.

It should be noted, in discussing demand, that the quantity demanded in any one time period depends not only on the price in that period, but also the price in each of many preceding periods. Gas-using devices, market penetration, the level of building insulation and other conservation measures, all depend on decisions made over several years past. Because natural gas has for years been priced very low -- average industrial gas price in the MPC system was about $.44 in 1973, compared with about $1.41 in 1976 -- current demand is based largely on decisions made with prices far lower than they are now or will be in the future. The lagged impacts of dramatic price rises have only begun to be felt on the demand for gas. Several years will pass before the full set of adjustments to today's higher prices can be completed by gas users.

Natural Gas Supply

The supply of gas to Montana Power has risen sharply in price, and in the case of Canadian gas (about 80 percent of total supply) the quantity available has fallen also. This stems largely from the fact that the Canadian government has reassessed its willingness to export gas, has raised its price dramatically, and has certified no new exports since 1972. Discussion between the author and Canadian officials in the Canadian embassy, in Ottawa, and in Calgary indicate a substantial range of possible adjustments to the scheduled 1977 level of Montana imports from Alberta at 29.2 bcf. At the national level, concern was expressed that future Canadian shortages might occur if exports continued, even at the declining rates mentioned in the May 18, 1976 letter from William Coldiron of MPC to Lt. Governor Bill Christiansen (1, p. 40). Yet the recent Canadian conservation and

fuel switching responses to sharply higher user prices, and supply effects of higher returns to producers also was noted in Ottawa. The possibility of accelerated delivery on existing export licenses was also mentioned. In Calgary, the worry was mainly over ability to get export licenses nationally, since most officials there seemed confident about the availability of gas well into the future. Indeed, the lack of ready customers is already hampering firms developing gas in Alberta. A significant surplus is forecast in Alberta for decades, and in Canada for at least two years. Again, the impact of price rises has only begun to be felt. Just as in the case of demand, the quantity supplied of gas at any time depends on the price available to sellers for some years past. Those past prices, and future expectations determine current reserves.

The prudent predictions on availability of Canadian gas still seem to be those contained in the Coldiron letter. It appears that Canadians will keep the border price of gas very close to the price of OPEC crude oil, delivered to the Chicago market. Thus for this study, gas is assumed available up to 29.2 bcf in 1980, 25.55 bcf in 1985, and none in 1990. A price of $2.50 per mcf in 1976 dollars, roughly the energy equivalent price of OPEC oil, is assumed to prevail in 1980 and 1985 for Canadian gas, in 1976 dollars, unless higher Montana prices prevail.

The future supply of gas produced in Montana will of course depend on the prices available to, and expected by those who search for and produce the gas. Frizzell surveyed Montana producers (1, pp. 65-75) and from their answers estimated production at various levels of wellhead gas price.

The price responsiveness in these estimates is roughly equivalent to supply elasticities estimated nationally of 0.5, where a doubling of price leads after a delay to a 50 percent increase in quantity supplied.

The desireability of converting coal to gas also is being discussed. If prices on gas available to MPC rose to around $4.00 per mcf, synthetic gas (SNG) from coal would apparently become feasible. The latest cost report on SNG processes, from C.F. Braun and Co. as interpreted by the author (see Appendix C) indicates that a price of $3.88 per mcf is a somewhat optimistic estimate, and this price will be used as the level at which MPC could get all the SNG it wanted, through 1990.

The supply of gas to MPC, as estimated here, is summarized in Table 4 below. From Frizzell's presentation, it seems reasonable to assume that in the future about 80 percent of Montana's production will be available for purchase by MPC (1, pp. 73-74).

Note that the $1.50 price is just above the new FPC interstate price of $1.42 per mcf on new gas. According to the MIT Energy Lab (3), this price should be at least high enough to provide equilibrium in national interstate markets, if it prevails in real terms for several years. Although interstate buyers are allowed to offer a higher price, up to about $1.75 in Montana as certain taxes are allowed to flow through, gas available in MPC territory is in general far from large interstate pipelines. This diminishes the willingness of interstate buyers to offer high prices. Thus a substantial supply available in Montana at this price seems reasonable. Until recently, the wellhead price was very low -- about $.25 per mcf in 1974 -- so that current Montana production is no indication of what will be available after a few year's exploration at $1.50.

Table 4

MPC Gas Cost Projections

Gas (bcf)	Gas Cost (per mcf)	Comments
1980		
0-44	$1.50	Montana Gas
52	2.00	Montana Gas
60-89.2	2.50	Montana Gas and Canadian
97.2	3.00	Montana Gas and Canadian
extra	3.88	SNG added
1985		
0-52	1.50	Montana Gas
60	2.00	Montana Gas
68-93.6	2.50	Montana Gas and Canadian
101.6	3.00	Montana Gas and Canadian
extra	3.88	SNG added
1990		
0-52	1.50	Montana Gas
60	2.00	Montana Gas
68	2.50	Montana Gas
76	3.00	Montana Gas
extra	3.88	SNG added

Utility pricing is based, by regulation, on average costs. Average gas cost is a blend of contract prices. But well owners will hold out for expected future prices if they are expected to rise. So in this report, the highest cost gas is assumed to determine average cost.

Gas utility costs other than gas costs, are assumed to remain constant, in 1976 dollars, at the 1977 test year level ($36,606,000) indicated by J.W. Heidt of MPC in his presentation in Docket No. 6454 before the Montana Public Service Commission (PSC) September 28, 1976. This includes MPC's estimate of a fair rate of return on capital. A non-gas figure of $1.4 million per year was added for the Great Falls Gas Company. The PSC may find these figures a bit too high. On the other hand, Federal income taxes are likely to be higher in future years, so this amount should be close to correct for similar quantities of gas delivered. The assumption is that if sales fall, little can be done to decrease non-gas costs. If deliveries increase, non-gas costs are assumed to rise proportionately. The rate structure is assumed to be flat within customer classes, at average cost for each class.

Results

When the data and assumptions discussed above are combined, and prices are found which allow costs to be met and quantity supplied to be equated with quantity demanded, the price and quantity projections in Table 5 result. An industrial price $.50 lower than that for other users is assumed (at 14.9 psi industrial pressure) to account for higher industrial load factors and lower distribution costs.

Table 5

Western Montana Natural Gas
Price and Quantity Projections

Year	Residential and Commercial (12.94 psi) ($/mcf)	Gas (bcf)	Industrial (14.9 psi) ($/mcf)	Gas (bcf)
1980	$2.34	23.5	$2.20	19.4
1985	$2.44	20.0	$2.27	18.3
1990	$2.40	22.4	$2.26	17.9

These figures have been rounded from more precise calculations. The controlling factor in changing these prices is declining average cost, since gas costs are at $1.50 per mcf in each case, and other costs are assumed fixed at $38 million. In all three projected years, consumption of gas is lower than its current level, as sharply higher prices have had time, by 1980, to cause user adjustments. Note that in all three years, the maximum adjustment allowed for residential and commercial users, by assumption -- one third in 1980, 50 percent per capita in 1985 and 1990 -- is reached in these projections. The full impact at the -.52 price elasticity of demand is not allowed in the estimates. In fact, FEA uses even greater adjustments, in their National Energy Outlook 1977 publication, in projecting for 1985 and 1990. Since substitution away from gas is at least as likely in Montana as elsewhere in the nation, one could make a case for even sharper drops in Montana gas consumption, both in industrial and in other gas uses. Table 6 indicates the effects of lower gas use.

An alternative assumption about industrial use, allowing industrial users to use just half the amount of gas assumed above, for 1985 and 1990,

is suggested by the very modest level of conservation beyond 1980 reported in the Frizzell paper. The results of this one changed assumption are noted below in Table 6.

Table 6

Alternative Assumption: Price and Quantity Projections With Lower Industrial Use

Year	Res. & Comm. Price ($/mcf)	Gas (bcf) at 12.94 psi	Industrial Price ($/mcf)	Gas at 14.9 psi
1985	2.70	17.3	2.60	9.3
1990	2.61	19.4	2.50	8.9

Note that gas prices are significantly higher due to lower volumes with fixed non-gas costs. For a utility with a transmission and distribution system fixed in cost and excess capacity, and gas costs below average costs, average costs are falling, so that extra consumption of gas (until capacity is reached or gas costs rise more than proportionately) will decrease average costs. This is a rationale for declining block rates.

If marginal cost pricing, in the form of declining block rates, were used in this situation, cost per unit of gas would fall. The situation is just the opposite of the case we now find often for electricity where growth forces new, very expensive generating plants to be needed. The alternative assumption of marginal cost pricing is illustrated below, where higher rates on infra-marginal units are assumed to cover non-gas costs, so each user pays, at the margin, only for the extra gas he uses.

Table 7

Alternative Assumption: Marginal Cost Gas Prices

Year	Residential and Commercial		Industrial	
	Avg. Cost ($/mcf)	Gas (bcf) at 12.94 psi	Avg. Cost ($/mcf)	Gas (bcf) at 14.9 psi
1980	$2.26	23.9	$2.13	19.4
1985	$2.27	24.1	$2.11	18.6
1990	$2.32	22.5	$2.26	17.8

These substantially lower average costs (not prices at the margin, as in previous projections) indicate the benefits to the system and to consumers of looking at marginal costs (gas, in this case) rather than only at average costs for pricing.

One other alternative seems worthy of examination. If purchased gas available to Montana Power Company costs an extra $.25 per mcf (at 14.9 psi) the costs are passed on directly to customers, since under the basic set of assumptions maximum conservation allowed has already been reached. The resulting prices are shown below.

Table 8

Alternative Assumption: Higher Purchased Gas Prices

Year	Residential and Commercial		Industrial	
	Price	Gas (bcf) at 12.94 psi	Price	Gas (bcf) at 14.9 psi
1980	$2.56	17.6	$2.45	19.4
1985	2.66	20.0	2.52	18.3
1990	2.62	22.4	2.51	17.9

Limitations of the Study

Any predictions 14 years into the future will be risky at best. Since gas prices depend on discovery rates, Canadian policy, Public Service Commission action, use-conservation, fuel switching, and many other factors, no prediction can be expected to be perfect. This study ignores inflation, so the user of this data must escalate the figures himself, if he wants other than 1976 dollars as a basis of comparison.

A single price elasticity of demand was used, although the limit on per capita gas savings modified the results. In fact, a lower elasticity could have been used with the basic assumptions, with no change in results. This is true because the upper limit on conservation proved to be the limiting factor on demand, and consequently the controlling price factor. The price of gas to the utility was constant in the relevant range, in each case.

The model of the utility used here clearly is oversimplified. It could be refined, at considerable cost, but the accuracy gained remains sensitive to the accuracy of other figures, such as future gas discovery and production rates.

It is worthy of note that in all projections above, Montana production, in response to the much higher returns to the producer, appears to be sufficient without Canadian imports, to meet Montana gas demands as dampened by user-price increases. In fact a good deal of gas could go to eastern Montana without affecting the results. If both supply and demand responses were less than those projected for 1980, two contrary influences might result: a) the cost of purchased gas might be higher, as Canadian purchases above $1.50 per mcf might be required; and, b) the average cost of

distribution will be less if more gas is delivered. The net impact is unpredictable, but is likely to be small relative to the projected prices.

It should also be noted that even at higher gas prices, and even if electricity prices were to remain at the present level (virtually an impossibility) natural gas remains a much cheaper source of residential heat. Even with allowance for a 60 percent efficiency in the burning of gas, a gas price of $3.20 would be cheaper per unit of heat than the very low electricity price of $.02 per kilowatt hour. Switching from gas to electricity for heating purposes does not seem to make sense on price or availability grounds either. On the other hand, at prices of $2.25 per mcf, gas faces strong competition from coal, which offer the same energy content per dollar even at prices above $40 per ton. Of course, handling and environmental problems differ, and acceptable home heating units using coal are only in the development stage. But for large industrial, or even large commercial installations, coal is a cheaper source of energy.

A more thorough study would include the Montana-Dakota Utilities area, would consider the effects of rising electricity costs on gas demands, and would incorporate more complex rate structures as well. It is the author's belief, however, that gas prices far outside the forecast range of about $2.20 to $2.70 per mcf are unlikely.

Appendix A

Informal Delphi Group

An advisory group, coordinated by James Nybo, was quite helpful in providing information and a "reality check" on assumptions used in this study. A meeting of the group was held December 6, 1976 in Helena. Individuals attending, in addition to the author, were:

Dr. John Duffield, University of Montana
Dr. Sid Groff, State Geologist
Dr. MacGregor Rugheimer, Montana State University
Mr. Alex Draper, Drapes Engineering
Mr. Greg Conniff, Drapes Engineering
Mr. Dick Bourke, Environmental Quality Council
Mr. Bill Headapohl, MPC District Manager
Mr. Geoffery Brazier, Consumer Counsel
Mr. Gene Huntington, Office of Budget and Program Planning
Mr. Phil Hauck, State Architect
Mr. Bill Opitz, PSC Utility Staff
Mr. Gordon Brandenburger, BPA (Kalispell)
Mr. Newell Anderson, Montana Trade Commission
Mr. James H. Nybo, MEAC

The group reached agreement that:

a) the coal gasification cost estimates in the C.F. Braun and Co. report, by Detman, are too optimistic, although the highest estimates in that report might reasonably be used; and,

b) the switching from natural gas use by industrial users in western Montana, reported by Frizzell in his EQC report are conservative beyond 1980; use of industrial consumption figures at half of those implied by Frizzell in 1985 and 1990 would be a reasonable alternative to explore.

Both suggestions were used in the present report.

References

1 Frizzell, Thomas, Montana's Natural Gas Supply Crisis, Montana Environmental Quality Council, Helena, MT, November 1976

2 Montana Energy Advisory Council, Energy Consumption in Montana Projection to 1990, Helena, MT, August 1976

3 M.I.T. Energy Lab, Energy Self Sufficiency, American Enterprise Institute Washington, D.C., 1974

4 Wheeling, Terry, Montana Historical Natural Gas Statistics, Montana Energy Advisory Council, Helena, MT, September 1976

Assistance in obtaining data and perspective was also received from Mr. J.W. Heidt and Mr. Roger Billings, of the Montana Power Company and from Mr. Earl Garrison of the Great Falls Gas Company as well as several colleagues in the Department of Agricultural Economics and Economics.

Appendix B

Detail on Computation of Gas Prices

The primary assumptions require average cost pricing, with flat rates within the industrial classification, and within the residential and commercial (other) classification. Also, revenues must equal costs including gas costs. A differential of $.50 per mcf is assumed, with industrial users getting the lower price due to higher load factors and lower distribution and customer costs.

The procedure for computing the gas prices which will meet these conditions is an iterative one. All prices and gas pressures are converted to the 14.9 psi industrial delivery base pressure. A search procedure is begun, with a sample price used, along with the price elasticity and initial price-quantity pair, to determine residential and commercial demand, and adding that to the fixed projection of industrial demand for that year. Gas costs can then be calculated and added to the fixed $38 million non-gas costs, and total revenue is compared with total cost. If revenue is too low, a higher price is tried, since both industrial and other revenues rise with price, given the inelastic gas demands. Higher prices are tried, with gas usage, gas costs, total cost, and total revenue recalculated until total revenue approximately equals total cost for that year.

In practice, the search procedure is simplified by the fact that in all cases except the marginal cost pricing case, prices must rise until residential and commercial use hits the minimum provided by the assumption

that a maximum of one third can be cut from the MEAC quantity projections in 1980 (2), and 50 percent in 1985 and 1990. In 1980, for example, if quantity falls one third, from 30.6 bcf to 20.4 bcf, the elasticity of -.52 implies that

$$-.52 = \frac{\Delta Q/Q}{\Delta P/P} = \frac{-1/3}{\Delta P/\$1.055} \quad \text{so that } \Delta P = \$.676$$

or P = $1.73 is sufficient to reduce residential and commercial consumption to its assumed minimum of 20.4 bcf. But gas costs total 20.4 bcf plus 19.4 bcf (industrial) times $1.50 per mcf, or

39.8 million x $1.50 = $59.7 million = gas cost.

Since other costs are $38 million, total cost is

$38 million + $59.7 million = $97.7 million total cost

If industrials are to receive gas at $.50 per mcf less, then the industrial price, P_I, and the residential and commercial price, $P_{RC} = P_I + \$.50$ must yield a total revenue of $97.7 million.

$$P_I\ (19.4) + P_{RC}\ (20.4) = \$97.7 \text{ million}$$

$$P_I\ (19.4) + (P_I + \$.50)\ (20.4) = \$97.7 \text{ million}$$

$$P_I = \$2.20 \text{ per mcf}$$

$$P_{RC} = \$2.70 \text{ per mcf}$$

When the $2.70 per mcf at 14.9 psi is converted to the equivalent energy price at 12.94, it becomes $2.34 per mcf.

With the alternative assumptions other than marginal cost pricing, the same procedure is followed. With the alternative of marginal cost pricing, where the declining block rates are assumed to put all users in the low tail block, at $1.50 per mcf gas cost, a single quantity is calculated

for residential and commercial demand. The initial price-quantity pair (for example in 1990, $.83 per mcf and 38.9 bcf non-industrial use) is changed to the appropriate quantity at $1.50 per mcf. This quantity is added to the industrial demand (17.8 bcf in 1990) and the sum is multiplied by $1.50 to get gas costs. This figure is added to the $38 million fixed non-gas cost, and the total is added to the product of $.50 times industrial usage to get the total revenue needed if all users paid the average revenue of residential and commercial users. This number, divided by total gas volume, yields the average revenue required from all but industrial users, who pay $.50 per mcf less.

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Appendix C

MEMO

December 20, 1976

TO: John Reuss, Executive Director of EQC

FROM: Richard Stroup, Ag. Econ. & Econ., Montana State University

RE: Review of Two Braun Reports on Gasification Costs

(I.) "Coal Gasification Commercial Concepts" Gas Cost Guidelines by Robert Skamser of C.F. Braun & Co. for ERDA-AGA (Jan. 1976, 38 pages).

(II.) "Preliminary Economic Comparison of Six Processes for Pipeline Gas From Coal" by Robert Detman of C.F. Braun & Co. for ERDA-AGA (presented at Chicago Gas Symposium, Oct. 18-20, 1976; 21 pages).

I. The purpose of the "Gas Cost Guidelines" was "to provide a consistent basis for comparing" gasification processes. To this non-engineer, it seems to succeed. It should be noted, however, that comparison of alternative gasification processes, rather than comparison of gasification with other energy alternatives, was the goal. It is quite possible that the former comparison could be handled well in the guidelines, while the figures derived would not necessarily be valid for application to the latter comparison.

The question of coal cost ought to be examined, especially if cost figures are to be examined relative to other energy forms. Coal is to be delivered, according to the guidelines, by conveyor belt onto plant grounds. No further benefication is to be required, and indeed the plant is to be located near the mine (pp. 8-10). Under these conditions, are the cost assumptions listed on p. 23 realistic? Dr. Lloyd Berg and Dr. S.L. Groff should be consulted. Clearly, location of the plant is crucial if the $7.50 per ton figure is to hold, as assumed.

Location also may enter as gas is assumed available at startup (p. 8). If other arrangements are required, costs may rise.

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It should be noted that water use is assumed to be minimized (p. 12). Air cooling is to be maximized. If water were plentiful, costs might be lower than these guidelines suggest. However, plants meeting the Guideline criteria will not be subject to further water savings, at least at reasonable cost.

The financial assumption (pp. 14, 15) seem optimistic for projects with so much uncertainty attached. This is especially true with the utility finance method. Such a method seems much more appropriate in the very low risk environment of utility in, say, the 1960's. With the product demand, technical, and cost uncertainties involved now in second generation coal gasification processes, utility financing seems totally out of place.

Even the private, discounted cash flow method outlined in the Guidelines may be optimistic and inappropriate. Given the uncertainties listed above, a projected 12% return on equity finance may be too low. In my opinion, both a cost overrun factor and rate of return figure 3% to 8% higher ought to be added if comparisons to established forms of energy are to be made with validity. Again, for internal comparison among gasification processes, this factor may be less important. Even here, however, comparing Hygas (pilot stage nearly complete) against Synthane (no pilot plant) requires some differential in cost overrun margin and/or rate of return required.

II. The second paper, an economic comparison of six SNG processes, appears to be largely done in conformance to the Cost Guidelines reviewed above. This may not be totally true, however (p. 4). Some of the work used was performed prior to availability of the Guidelines. Results affected by this potential problem are not identified.

As the report states (p. 1) "a conclusive, comprehensive analysis" of the processes is not possible at this time. Costs reported were derived from "bench scale experiments or computer models" of the processes. Major uncertainties seem inevitable in such a preliminary analysis.

The report aims (p. 1) to be an "impartial analysis" of alternative processes. The attempt to use the Guidelines for comparison purposes is a laudable effort in this regard. The goal seems unreachable at this stage of data availability, however. As the author points out, the best available data is from the process developers (p. 1). Since funds for future development are scarce and eagerly competed for, each developer has every incentive to give optimistic estimates whenever hard figures are unavailable. An "impartial analysis" seems unlikely, based on data gathered in such an environment. This is true with respect to inter-process comparisons, where processes using the least standard equipment

(subject to the most cost uncertainty) have the greatest leeway to estimate optimistically or otherwise. The problem is greatly accentuated when one wants to compare these SNG processes against other energy options with much less uncertainty attached, and thus with more easily (and precisely) estimated costs. The expected bias clearly favors the high-risk options.

As mentioned in the "Gas Cost Guidelines" review above, the financial projection techniques used here seem optimistic in themselves. Even the higher cost private financing option, at 12% return DCF, appears optimistic in light of potential cost overruns and the various risks involved. The utility finance option seems totally inappropriate for this high-risk category of large investment. In short, even the high cost estimates in this report (Table p. 9) are probably optimistic.

In brief summary, these two reports seem to perform a valuable function in light of their stated goal: the best available comparison, at this time, among the various gasification options producing SNG. The reports are much less valuable in allowing comparison between SNG costs and the costs of other energy options.

CC: Lt. Governor Bill Christiansen